A Brief Analysis of the Economic Benefits of Wind Power in Washington State

Over the past several years the amount of electricity generated from wind power has increased substantially, both around the world and in the U.S. By the end of 2001 world wind generation nameplate capacity (the maximum amount of electricity generated under the most favorable conditions) stood at around 24,000 MW, with 6,500 MW being added last year alone. In the U.S. approximately 1,700 MW of wind generation capacity was added in 2001, bringing total nameplate capacity to 4,260 MW. In the Northwest several wind power projects have come on line during the last few years. The Vansycle Ridge, Condon, Klondike, and Stateline projects recently entered service in Oregon (combined nameplate capacity of approximately 158 MW). In Washington, the Stateline project entered service in 2001 (Washington's portion of this project is 178 MW), and the Nine Canyon project (48 MW) recently entered service (October 2002.) A number of other wind power projects have been proposed for the Northwest, though many have been put on hold because of low electricity demand, declining wholesale electricity prices and reduced economic activity due to the recession.

Since the crisis in the west coast energy markets, which began in 2000 and lasted until the summer of 2001, approximately 4,400 MW of new power generation capacity has been built, is under construction, or has received the necessary permitting in the Northwest. Approximately 93 percent of this new capacity is, or will be, natural gas fueled combined cycle combustion turbines (CCCTs.) While CCCTs are relatively clean and economical, an over reliance on natural gas fueled electricity generation for new capacity presents some challenges for the region. These challenges include; regional pipeline constraints, increased upward pressure on natural gas prices for all sectors of the economy, exposure to fuel price volatility, increased greenhouse gas emissions and increasing reliance on an out of state fuel source. Renewable energy sources, such as wind power, offer an alternative to natural gas fired CCCTs electricity generation.

This document briefly summarizes the advantages and economic benefits of wind power relative to electricity generated from natural gas powered CCCTs. Economic impacts of a completed wind power project near Condon, Oregon, and two proposed projects near Ellensburg, Washington are briefly reviewed.

Cost competitive with other new sources of generation

The price of wind power has dropped faster than the cost of conventional electricity generation. Wind power today costs about 20 percent of what it cost in the mid 1980's and is expected to decline further over the next 10 years, though at a slower rate. In a 1996 report titled "Energy Technology Status Report", the California Energy Commission estimated the production costs from a number of sources for electricity. Table 1 presents these costs: the price of wind power is shown with and without the Production Tax Credit (PTC.) The PTC is a federal subsidy, currently at 1.8 cents/ kWh, guaranteed over the first 10 years of production. The US Congress recently renewed the PTC (March 9, 2002, H.R. 3090) for a two-year period; a three-year extension through 2006 is being considered.

Table 1: Costs for New Sources of Electricity Generation

Fuel	**Levelized cost** (cents/kWh) (1996 $)
Coal	4.8-5.5
Gas	3.9-4.4
Hydro	5.1-11.3
Biomass	5.8-11.6
Nuclear	11.1-14.5
Wind (w/o PTC)	4.0-6.0
Wind (w/ PTC)	3.3-5.3

All costs estimated for investor owned utilities. The PTC used was 1.5 cents/ kWh

Land owner revenues

Because wind power projects have a much larger footprint than conventional power plants, they generate comparatively greater landowner revenues either through leases, royalties or direct purchases of land. Leases and royalty payments (fraction of project revenue) typically run $2,000 per turbine. Since wind projects are usually sited in rural communities these payments provide an additional source of revenue for rural landowners. Because the wind turbine tower only occupies a small amount of total project area (typically four percent or less of the footprint area) farming and ranching operations are often not greatly affected.

Property taxes

Wind energy projects are very capital intensive and as a consequence generate significant property tax revenues for the counties where they are built. Reported wind power generation capital costs for utility projects are approximately $1000 per kWh: some reported values are by Clemmer (1998) at $945 per kWh and the Tellus Institute (2002) at $900 per kWh. For natural gas powered generation, capital costs are approximately $400 – 500 per kWh. In addition, wind power projects typically have capacity factors of 30 to 35 percent, while gas powered generation capacity factors are 70 to 95 percent. The net effect of higher capital costs and lower capacity factors for wind power is that capital investments for wind power are four to eight times higher than a similar output natural gas powered generation facility, resulting in much higher property tax revenues. In Washington, property tax revenues are in the range of $10 to $15 per $1,000 investment.

Other sources of revenue

Green power programs are voluntary programs sponsored by utilities, which allow customers to buy blocks of green power (from renewable resources other than hydro) for a slight premium. Because wind energy is a renewable energy resource, a premium can be charged for electricity from wind energy facilities.

Many states and a few cities have or plan to introduce either Renewable Portfolio Standards (RPS), or greenhouse gas mitigation policies: California for instance has recently adopted a RPS calling for 20 percent of its electricity to come from renewable resources by 2017 (S.B. 1078, Sept. 2002.) These entities (states or cities) will need to produce electricity from renewable resources or buy offsets from facilities in other locales. In the near future wind energy facilities in Washington State may be able to sell offsets or credits for those trying to meet a RPS or greenhouse gas emission targets.

Job Creation

Construction of either a wind or a conventional energy facility will generate jobs for local communities and the state as a whole. Compared to conventional energy projects wind energy projects generate slightly more jobs per dollar invested and significantly more jobs per million kWh of energy generated. A study by the New York State Energy Office found that 10 million kWh of electricity produced by a wind energy project would generate 66 percent more jobs than a similar output natural gas CCCT. In essence the labor and capital inputs (see property tax section above) are significantly greater for wind energy facilities, which begs the question "how can wind energy be competitive with natural gas powered CCCTs if its' labor and capital requirements are so much higher". The reason is that while the fuel source for a wind energy facility is free, a natural gas powered CCCT must make sizable fuel purchases: approximately 60 to 70 percent of the total lifetime costs for a natural gas CCCT are directed towards fuel purchases. Since Washington produces no natural gas (excluding landfill methane gas), power plant purchases of natural gas represents money that is sent out of state.

Condon, Oregon wind project: Expenditures and taxes generated

An accounting of the revenues and taxes generated by the Condon wind project in Oregon is presented here. Wind projects, such as the one at Condon, also have the benefit of producing jobs for rural communities, which tend to be more depressed and less dynamic than urban communities. Table 2 below lists most of the expenditures made at the 50 MW Condon wind project in Oregon in 2000 and 2001.

Table 2: Expenditures for Condon, Oregon Wind Project

Total project cost	$55-60 million
Annual revenues	$4.5-5.3 million
Construction costs	$11.5-12.5 million
Local expenditures	$445-570,000
Regional expenditures	$3.7-4.5 million
Transmission interconnect	$2-2.5 million
Annual land leases: Year 1-10 (Year 11-20)	$110-135 ($175-210) thousand
Annual local O&M expenditures	$170-240 thousand
Annual regional O&M expenditures	$24-60 thousand
Annual property taxes	$540-580 thousand

Source: Condon wind project EIS (2001), Table 3.10-2 and page 3-48 to 3-50.

The estimated dollars going to the local and regional economy per year from the Condon wind project are presented in Table 3 below. With a 50 MW nameplate capacity, this is an intermediate size wind project.

Table 3: Condon wind project, estimated dollars to the local and regional economies

Category	Year	Amount
Local dollars	0-1	$445-570 thousand
	1-10	$549-663 thousand
	11-20	$614-738 thousand
Regional dollars	0-1	$3.7-4.5 million
	1-20	$24-60 thousand

Source: Condon wind project EIS (2001), pages 3-48 to 3-50.

Indirect and induced expenditures and job creation

The impact on the job markets of any energy project, whether it is a wind energy project or a conventional energy project, goes beyond the temporary and permanent direct expenditures and jobs that are created. Firms that provide direct expenditures must purchase intermediate materials, supplies and labor for the project, which result in indirect expenditures and jobs being created. The direct and indirect expenditures/jobs increases local purchasing power and spurs additional spending in the local and regional economy. Economists commonly refer to this outcome as the multiplier effect. Typical multipliers are around 2.0, which means for every direct job an additional indirect or induced job is created. Because wind energy projects are more labor intensive than conventional energy projects, such as CCCTs, and create more direct employment, they also result in larger indirect and induced employment through the multiplier effect.

Kittitas County proposed wind projects: Zilkha and EnXco

Two wind energy companies are in the process of developing plans for wind projects near the town of Ellensburg in Kittitas County Washington. EcoNorthwest, a regional consulting firm, was contracted to evaluate the combined economic of the two proposed projects. The total number of wind turbines for both projects is 260, and the projected total nameplate capacity is 390 megawatts. EcoNorthwest used the IMPLAN economic model to estimate the economic impacts of the projects. Table 4 below illustrates the direct indirect and induced economic impacts of the proposed projects for Kittitas County.

Table 4: Economic Impacts of Proposed Wind Projects in Kittitas County

Economic Impact *		Wages	Business Income	Personal Income	Other Income	Jobs
Construction Phase	Direct	$8,420,000	$1,027,000	$9,447,000	$388,000	95.2
	Indirect	$732,000	$139,000	$871,000	$242,000	30.3
	Induced	$1,050,000	$225,000	$1,275,000	$234,000	60.0
	Total	$10,202,000	$1,391,000	$11,593,000	$864,000	185.5
Operations Phase	Direct	$2,165,000	$216,000	$2,381,000	$819,000	22.0
	Indirect	$77,000	$30,000	$107,000	$22,000	3.1
	Induced	$486,000	$105,000	$591,000	$347,000	28.2
	Total	$2,728,000	$351,000	$3,079,000	$1,188,000	53.3

* Expressed in 2002 dollars.

EcoNorthwest estimates that the two wind projects will increase income to the county by $12,457,000 during the construction phase, a period of up to two years, and by $4,267,000 annually due to project operations.

The projected increase in economic activity from the wind power projects will also increase tax revenues for Kittitas County. EcoNorthwest estimated increased annual county property revenues of $2,683,000 from the wind farms and increased revenues from higher values on other properties of $202,000 for total increase in tax revenues of $2,885,000.

Resource diversity

By adding wind power to the regional generation mix we are in effect diversifying our portfolio. As with a financial portfolio, diversification reduces overall risk. The social and financial risks from a low hydro year or natural gas fuel price volatility are reduced when wind power, or other renewable energy resources, is added to the regional generation mix. See the RAND report *Generating electrical power in the Northwest: Implications of alternative technologies* for a more detailed discussion of this subject

Reduced pressure on natural gas prices

Adding substantial amounts of wind power to the regional generation mix also takes some demand pressure off natural gas prices. The beneficiaries of this effect are not only electricity customers, but also industrial, commercial and residential direct consumers of natural gas. In a 2002 report the Energy Information Administration (EIA) estimated that an energy portfolio mix with 10 to 20 percent renewable energy resources would reduce the upward pressure on gas prices and lower long-term prices by 5 to 10 percent.

Environmental benefits

Wind energy projects also have sizable environmental benefits relative to conventional energy projects. Even compared to natural gas fired CCCTs, which are the cleanest fossil fueled energy electricity generation, wind energy projects produce very small amounts of criteria air pollutants such as carbon monoxide, nitrogen oxides and fine particulate matter. In addition the greenhouse gas emissions associated with wind energy are very low compared to conventional generation technologies. A 2002 RAND report presented the amount of carbon monoxide, nitrogen oxides and sulfur dioxide emissions that would be avoided by replacing 20 percent of future CCCT generation with renewable energy resources, such as wind power. Table 5 below shows these reductions.

Table 5: Effect of replacing future CCCT generation with renewable resources

Emission	Cumulative emission reduction through 2020 by replacing 20% of CCCT generation	Total emissions in 1998 from Power Plants in the Pacific Northwest [a]
NO_x (kg)	10,802,738	80,182
SO_2 (kg)	227,426	112,413
CO_2 (kg)	46,534	41,682

[a] Data from the Environmental Protection Agency, 2000

Conclusion

A number of advantages that accrue from generating electricity from wind power were briefly described above. In summary, the advantages of wind power relative to natural gas or coal fired electricity generation are:

- Significantly greater landowner revenues from leasing of land or payment of royalties.
- Generation of more local jobs during the construction and operation phases of the project.
- Significantly greater local tax revenues due to the larger capital inputs necessary for a wind project.
- Potential revenues from sale of “green power” or sale of carbon dioxide emission offsets/credits.

- Greater electrical generation resource diversity and reduced exposure to price swings caused by a low hydro year or fuel price volatility.
- Reduced demand for natural gas and consequent upward price pressure.
- Environmental benefits from reductions in emissions of health related air pollutants and greenhouse gases.

References

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